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ABSTRACT

The study, using a subsample of young men and women from the 1969 National Longitudinal Survey, examined the effects of differences in educational attainment on wages and occupational status by sex and race. In particular, the economic rationale for women's higher rates of high school graduation and lower rates of college attendance and graduation were explored. It was found that, relative to men, women experience greater gains in wages and in occupational status from high school graduation, and greater gains in wages but lesser gains in occupational status from college graduation. It was concluded that economic factors provide rationale for the greater high school graduation rates of women, and a possible rationale for the greater college graduation rates of men. (Author)

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FINAL REPORT

Evaluating the Return to the Education of Women: ECONOMIC RATIONALE FOR SEX DIFFERENCES IN EDUCATION

National Institute of Education Project No. N1E-G-74-0094

Janice Fanning Madden

Assistant Professor

Department of Regional Science

University of Pennsylvania

Phila., Pa.

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Abstract

This study, using a subsample of young men and women from the 1969 National Longitudinal Survey, examines the effects of differences in educational attainment on wages and occupational status by sex and race. In particular, the economic rationale for women's higher rates of high school graduation and lower rates of college attendance and graduation is explored. It is found that, relative to men, women experience greater gains in wages and in occupational status from high school graduation, and greater gains in wages but lesser gains in occupational status from college. Economic factors provide rationale for the greater high school graduation rates of women, and a possible rationale for the greater college graduation rates of men.

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I. Introduction

Much effort has been devoted to explaining differences in the labor market experiences of men and women and black and white workers. Economic research has focused primarily on quantifying factors which account for wage and employment differentials by race and sex. One of the characteristics of prime importance in determining wage and employment status is formal educational attainment. Because of this and because the mean number of years of school attendance of blacks is lower than that of whites, education has played a major role in nearly all analyses of employment and wage differentials by race. However, unlike blacks and whites, men and women workers in the United States have the same mean education, 12.2 years.[1] Most likely, it is for this reason that formal education has been largely ignored as a factor contributing to wage and employment differentials between men and women.

Nonetheless, other than means years of attendance, there is little similarity in the educational experiences of men and women. The differences in fields of study and specialization are well documented.[2] But more basic is the difference in the variance in the level of educational attainment among men and among women. Women have a higher probability of terminating their education with a high school diploma while men have a higher probability of terminating their education either short of a high school diploma or at a college level.

These differences in patterns of educational attainment could account for the lower wages and occupational ranking of women. Alternatively, a grade school, a high school, or a college education may provide different wage and occupational opportunities for women than they would for men. In this case, the labor market opportunities would determine educational attainment patterns

rather than vice versa.

This study investigates such a possibility by empirically measuring the effect of different levels of education on wages and occupational status by sex and by analyzing whether these factors constitute an economic rationale for the observed differences in education by sex.

II. Review of Related Research

The definitive work on the economics of human capital is Gary Becker's Human Capital[2]. Becker defines human capital as "activities that influence future monetary and psychic income by increasing the resources in people."[3] Education is a particular form of human capital.

Becker hypothesizes that profitability is the single most important determinant of the amount invested in human capital and proposes methods of measuring profitability similar to those used to measure the profitability of investment in physical capital (i.e. present value, internal rate of return). He suggests that age, mortality, morbidity, ability, and the amount of switching between activities all influence the amount invested in human captial. He concludes that women would invest in human capital that increases their productivity both as housewives and as participants in the labor force while men would concentrate more on labor force oriented human capital.

Becker then chooses to devote his empirical discussion primarily to males, devoting only two pages in a two hundred page book to investment in female human capital. In these pages, Becker finds that educated women experience smaller increases in income than their male counterparts. This is attributed to lower rates of labor force participation. Observing that family income of educated women is higher than that for men, Becker suggests that part of the return to woman's education may be the increased probability of marrying a "more desirable man." It would seem, however, that this result is also consistent with more educated women being more efficient in the household and,

therefore, positively influencing her husband's earning ability.

While Becker indicates that the increasing differential between men and women as education increases suggests that women would be less inclined to attend college than men, he does not indicate why women are more likely to finish high school nor does he attempt to rigorously measure returns to the education of women.

Theodore Schultz in a recent essay on the state of human capital research has criticized the male orientation of human capital work:

> If it is true that investment in human beings if only for males, we would do well to drop the term "human capital." It would serve notice that human capital is sex-specific! Despite all of the schooling of females and other expenditures on them, they appear to be of no account in the accounting of human capital.[4]

Indeed, voluminous studies of the returns to education have primarily focused on males without any mention of females.[5] However, there are some exceptions worthy of note.

Hines et. al, [9] use 1960 U.S. Census data to compute the private and social internal rate of return for each level of education for different race-sex groups. They find white women have a lower average rate of return to education than do white men, black men, and black women, although white women experience a greater marginal rate of return to high school graduation than do the other groups. While this study provides insight into differential rates of return by sex, it only measures market returns to education since the return is measured solely with annual income data which can not indicate any effects of education on household productivity. Since this effect is substantially greater for women it must be included for return rates to explain education patterns.

A. W. Neimi [14] updates the Hines study using both 1960 and 1970 Census data and improves the sex comparability of the estimated returns by adjusting

annual income data for sex differences in labor force participation. Neimi finds women experience higher rates of return on post college education but lower rates on high school and college than do men. The Neimi study does not explain why women cluster at the high school graduate category rather than the post college level.

Jacob Mincer [12] performs an ingenious manipulation on 1939, 1949, and 1959 U.S. Census earnings data by age and education to indirectly estimate expenditures on training outside of school. He is able to conclude that for males, higher levels of formal education are supplemented with even greater expenditures on non-school training. In performing the same manipulations on female earnings and age data, Mincer found that only one-tenth of training expenditures in the U.S. are invested in women. He offers this as an explanation of the flatter age-earnings curves observed for women. Mincer does not use any training data but infers training costs from earnings data. He does not find any pattern of training expenditures related to education which explains the concentration of women in this high school graduate category.

More recently, Mincer has teamed with Soloman Polachek [13] to produce an intensive study of capital investments in women. Mincer and Polachek attempted to estimate the effect of human capital accumulation (defined as investment in formal education, training, experience, health, and migration) on earnings over a lifetime. The study focuses on market returns to education as measured by wages and salaries of a sample of U.S. women aged 30-44. In this study, direct data on education and training are utilized. Equations are derived to explain the accumulation of human capital and to relate human capital to earnings. Mincer and Polachek conclude that women accumulate less human capital than men because they experience lower rates of return. Measuring returns in terms of the effect on lifetime earnings, they correlate these

lower returns with decreasing female labor force participation and with the extent of discontinuity in work experience relative to the male cohort. While Mincer and Polachek find substantially higher rates of depreciation of skills for females who drop out of the labor force for a period of time as the level of female educational attainment increases, they do not address the question of sexual differences in the distribution of education. The reported behavior of depreciation rates would again indicate that women should be less inclined than men toward the achievement of all levels of education. The results do not indicate why women would be concentrated at the high school graduate level. Also, neither occupational discrimination nor non-market returns are considered as explanations for educational attainment.

Arleen Leibowitz [10] is currently studying production within the household. Though she is not attempting to value this production, she reports that women college graduates devote less time to housework and more time to child care than their counterparts with less education. This result indicates that college changes the preferences of women and/or increases productivity in child care work relative to housework.

The substitution of child care for housework in the household activity of college-educated women indicates that college does affect productivity in the home as well as in the labor market. Clearly, if the returns to education of women are to be estimated, the returns to the household must be measured. Leibowitz's work points to child care as an appropriate area in which to begin such measurement.

The studies which deal with males are also of significance to the proposed research in that they discuss the relationship between discrimination in the labor market and educational achievement.

Finis Welch [17] examines the differences in earnings of black and white

males assuming that less educated workers complement rather than substitute for better educated workers. He finds that integration can affect productivity in two directions. First, since black and white workers have different levels of education, total productivity is increased by integrating the work force. But secondly, the presence of black workers disturbs the white worker and therefore decreases their productivity so that integration of blacks and whites acts to decrease total productivity. Integration will take place only when the first effect is larger than the second effect so that the net outcome is an increase in total product. If black workers are the object of prejudice and not vice versa, there are costs associated with hiring the marginal black workers not associated with hiring the marginal white workers. Therefore, Welch reasons, black earnings are depressed relative to white earnings due to discrimination, but are higher than they would be without integration due to the increases in productivity prompted by employment with a complementary factor of production.

Welch's analysis of the role of education differences in producing complementary relationships between segments of the labor force is of particular interest in studying the differences in educational attainment between men and women. Though female occupations are often obvious complements to male occupations (doctor-nurse, business executive-secretary, principal-teacher, etc), Welch only analyzed the complementority of black males and white males in the labor force.

Welch's conclusions lend encouragement to the approach of this study. If the sexual division of labor places males and females in complementary occupations, and if, as Welch indicates, different levels of education complement each other in terms of total productivity, it is appropriate to investigate whether males and females choose their level of education with respect to their respective occupational choice sets and to investigate the effect this

has on wage and employment discrimination.

Another study has developed a means of testing whether males and females are restricted to certain occupational choice sets because of their sex. Taubman and Wales [16] have studied a sample of males who passed the Aviation Cadet Qualifying Test during World War II to obtain estimates of the rate of return to higher education and, more importantly for the proposed study, to determine the method by which education affect earnings. As explained above, education can increase earnings in two ways: first, by increasing productivity; secondly, by acting as an artificial entry barrier to higher paying jobs. Of particular interest is the method utilized to determine if occupational screening has occurred. Taubman and Wales compare the actual occupational distribution of individuals at various education levels with the "expected" one with free entry. The authors conclude that educational screening did occur since the actual fraction of high school graduates in low paying occupations was considerably greater than the expected whereas the actual and expected fractions are equivalent for college graduates. Due to their all male sample, no implications were drawn for females or for screening by education and sex.

III. The Methodology

In analyzing the economic basis for educational choices, it is necessary to take account of the effect of education on earnings in the labor market and on productivity in non-market work. In this section, methods for exploring these alternatives are discussed.

Economic theory on the relationship between education and earnings stipulates that wages (W) of worker i are a function of education (E) and n other worker characteristics (Z) :

$$W_i = f(E_i, Z_{ni}) \qquad (1)$$

The theory argues that since wage rates are equivalent to the marginal product of the worker, education increases wages by directly increasing worker productivity. Other explanations, such as signaling and "licensing" are investigated in Appendix B using the Taubman-Wales methodology discussed above.

Since the output of non-market or household production is not subject to explicit pricing, or even physical measurement, there is no unique quantification of the effect of education on household productivity. This paper uses an implicit measure of the productivity of educated labor in the household production function. Gary Becker's [3] argument that the wage rate measures the value of time in non-job usages for members of the employed labor force is widely used. Simply put, if a worker values nonlabor time at a rate higher (less) than her or his wages, that worker would reduce (increase) the number of hours on the job, so that in equilibrium the wage rate indicates the marginal value of time in all other uses.[6] Therefore, the houseworker employed outside the home will adjust the work schedule so that the value of the marginal hour spent in housework is equivalent to the wage. The hourly wage rate, then, indicates the marginal productivity of the worker in the home as well as on the job. If the return to education is measured in terms of the effect on the hourly wage rate, the value of education in non-market activities is implicity included.[7] Other alternatives for measuring the non-market return on education are discussed in Appendix A.

This methodology is only appropriate for measuring the household productivity of women (or men) who participate in the labor force. If an individual does not work for wages at all, then the marginal value of time in non-market production is greater than the expected wage rate.[8] Since this is more prevalant among women than among men, using the hourly wage rate to measure the return to

education is still likely to underestimate the return for women relative to men, but it is a better index than annual income. For this reason, the hourly wage rate is used as the dependent variable to estimate both market and non-market returns to education.[9] Equation (1) is estimated in the form:

$$W_i = e^{a_0 + a_1 E_i + \sum_{j=2}^{n+2} a_j Z_{ij} + u_i} \qquad (2)$$

where u is assumed to be normally distributed error.

The independent variables included in the vector Z_n of equation (2), which sort out influences on productivity other than education, include measures of personal characteristics, family and class background, and ability.

In order to determine both the average effect of a year of education on productivity and the marginal effect of any specific year of education, equation (2) is estimated twice, using two different specifications of E. The first specification defines E_i as a single variable measuring years of schooling completed by respondent i. When this education variable is used, the coefficient a_i in equation (2) indicates the average effect of a year of schooling on productivity in the market and in the home. The second specification measures education with a series of 0-1 dummy variables, E_{ik}, such that E_{ik} has a value of 1 when respondent i's last completed year of education is level k and has a value of 0 for all other levels. Equation (2) is then specified:

$$W_i = e^{a_0 + \sum_{k=1}^{6} a_k E_{ik} + \sum_{j=7}^{m+7} a_j Z_{ij} + u_i} \qquad (2a)$$

The coefficient a_k indicates the marginal effect of (k+7) years of education relative to 7 or less years of education. By subtracting a_{k-1} from a_k, the marginal productivity effect of each level of education can be determined.

IV. Description of the Data

The data used in this study are a subsample of the National Longitudinal Survey of Labor Force Behavior (NLS) sample of the young non-institutionalized civilian male and female population. Only those respondents between 18 and 25 years of age in 1969 who reported earnings and were no longer enrolled in school are included. (Preliminary analyses of data collected in the earlier years indicated that 1969 was the best year to use for sex comparisons.) The female subsample consists of 2056 individuals out of 5158 initially selected for NLS in 1968.[10] The male sample consists of 1527 individuals out of 5225 initially selected for NLS in 1966.[11] Table 1 indicates the distribution of educational attainment by sex, race, and age for this sample and lists the sample means and standard deviations of wages and education.

This sample of relatively young workers presents both advantages and disadvantages for studying the influence of education on wages and employment. Since a data set with enough detail to control for education, ability, training, experience, and family background is desirable, the NLS data are an excellent source of such information. However, because these data are collected

TABLE 1

SAMPLE CHARACTERISTICS OF THE NATIONAL LONGITUDINAL SURVEY

RESPONDENTS NOT ENROLLED IN SCHOOL AND BETWEEN THE AGES OF 18 AND 25 IN 1969

	Women					Men				
	All	White	Black	18-21	22-25	All	White	Black	18-21	22-25
Sample Size	2056	1473	583	1085	971	1527	1074	453	796	731
Ln Wage Mean	5.199	5.245	5.082	5.122	5.285	5.568	5.645	5.367	5.466	5.679
Standard Deviation	.352	.352	.348	.345	.358	.417	.398	.405	.395	.412
Education	11.9	12.2	11.3	11.6	12.3	11.5	11.9	10.5	11.2	11.8
Standard Deviation	2.0	1.9	2.1	2.1	2.4	2.7	2.6	2.6	2.2	3.1
Education Breakdown:										
Fraction with exactly 8 years	.034	.026	.055	.041	.027	.056	.047	.077	.041	.073
9-11 years	.166	.130	.256	.176	.155	.215	.179	.302	.237	.192
12 years	.582	.606	.522	.665	.489	.444	.465	.395	.528	.353
13-15 years	.116	.126	.089	.093	.140	.130	.157	.066	.116	.146
16 years	.067	.082	.031	.006	.136	.067	.084	.026	.024	.114
17 or more years	.012	.016	.002	--	.024	.022	.031	.002	--	.047

on only four age cohorts[12] of the population, only selected age groups could be studied. Furthermore, only the younger cohorts provide a male-female cross-sectional sample of the same age in the same time period.

Since young women are less likely to have dropped out of the labor force due to family reasons than are older women, their work experience both quantitatively and qualitatively, is more similar to their male cohort than would be the case for older women. Also, it is a much simpler task to quantify the value of education in the performance of household tasks when there is nearly continuous attachment to the labor force.

There are also some difficulties to be considered in using this data to analyze sex differences in the return to education.

In 1969, the Selective Service System was clearly non-randomly selecting which 18-to-25 year old young men were out of school and working in the civilian sector. Since the subsample analyzed in this paper excludes individuals in the military or in school, most of the young men who are included were classified by Selective Service as I-A, IV, III A, or IV F. The work and education experiences of young men with any of these draft classifications are not easily extrapolated to the general population, as indicated by the group variable means reported in Table 2. Those young men classified I-A , which indicates immediate availability and fitness for military service, probably viewed their current job situation as temporary. Those classified as IV or IV F, which indicates varying degrees of mental and/or physical unfitness for military service, may have been similarly unfit for civilian employment. Those classified as III A, which indicates deferment due to responsibility for dependents, may have had different work motivations than other young men.

Besides selectively eliminating young men from the subsample used in this study, the draft also affected the behavior of those included in the study.

Table 2

SAMPLE CHARACTERISTICS OF YOUNG MEN, NOT ENROLLED IN SCHOOL, BY DRAFT CLASSIFICATION.

	DRAFT STATUS				
	I-A	I-Y	III-A	IV-F	All Other Classifications
Fraction Black	.394	.321	.215	.512	.194
Mean Father's SES code	25.2	29.3	26.9	21.5	30.1
Fraction Married	.229	.365	.940	.361	.478
Ln Wage Mean	5.468	5.551	5.717	5.326	5.630
Fraction for which health restricts activity	.032	.061	.050	.037	.023
Mean Weeks Worked	39.2	45.2	49.5	43.5	42.5
Mean Years Experience	1.7	3.2	4.4	4.0	3.3
Mean Number of Dependents	.5	.6	1.5	.7	.6
Mean IQ Score	98.0	98.5	98.5	95.4	101.3
Mean Education	11.4	11.5	11.5	10.2	12.1
Mean Own SES Code	23.2	28.9	3[illegible].5	19.8	36.8
Fraction in South	.46	.46	.42	.65	.37
% of Subsample	14.8	26.1	19.6	11.3	28.2*
% of Total NLS Sample	11.5	12.2	15.2	11.1	50.0*

* The difference in these two numbers is primarily due to non-responses (26.9% of NLS sample), not draft age (13.3% of NLS sample), and students (11.4% of NLS sample). All of these individuals are ineligible for the 18 to 25 year old, not enrolled in school, subsample. This leaves 25.8% of the NLS sample and 28.2% of the subsample with draft classifications indicating that the individual is a conscientious objector occupationally deferred, a reservist, or a student taking military training.

Of particular interest,the draft exemption for those in school enccuraged young men to acquire more education than they would have in the absence of the draft. Likewise, the draft exemptions for particular jobs also encouraged employment in those jobs at lower wages than would have been the case without the draft. Therefore, the estimate of the return to education for the young men in this subsample may be lower than if a more random sample of young men could be analyzed. For this reason, this study's results are broken down by draft classification so that overall biases may be taken into account.

Other sources of bias arise from the relative youth of the sample. Workers with higher levels of education are underrepresented: for each year of age, those individuals excluded because they were still in school have a higher level of educational attainment than those included in the subsample. To control for this bias, results are broken down into two age categories, 18 to 21 years old and 22 to 25 years old, since age-education correlation is less significant for 22 to 25 year olds.[13]

Finally, since these data cover a very young cohort of the working population, the full effects of education on employment and wages are not easily extrapolated. The wage-employment profiles of the respondents are indicative of future patterns, but not perfectly so. Although the labor force attachment of men and women in this age group is similar, there is no reason to believe that the expectation for future attachment is similar. To the extent that these expectations differ by sex, preferences for jobs with higher earnings in the present as opposed to jobs with higher earnings in the future will differ by sex. Likewise, discrimination in the labor market may increase with age at different rates for different education groups. Therefore, present levels of remuneration may not consistently reflect the present values of future

Income streams for all race-sex groupings. For these reasons, returns to education are also measured in terms of changes in the Duncan Socio-Economic Index of Occupations (SES).[14] This index ranks the "prestige" of occupations on a scale of 0 to 100 with ascending numerical values indicating ascending prestige. This index is computed from a linear combina- of average educational attainment and average income of those working in the occupation. This index then, provides some indication of the future of the earnings potential of the 18 to 25 year olds by education. Therefore, the following equations are also estimated:

$$SES_i = a_o + a_1 E_i + \sum_{i=2}^{n} a_j z_{ij} + u_i \qquad (3)$$

and

$$SES_i = a_o + \sum_{k=1}^{6} a_k E_{ik} + \sum_{j=7}^{n+7} a_j Z_{ij} + u_i \; . \qquad (3a)$$

E_{ij}, E_i, and E_{ik} are defined as in equations (2) and (2a).

V. Explaining School Attendance Patterns

Estimates of average and marginal percentage changes in wages due to education, based on estimations of equations (2) and (2a), appear in Table 3. Similar estimates of the changes in SES, based on estimations of equations (3) and (3a) appear in Table 4.[15] Table 5 lists the specific variables included in 7, as well as their coefficients estimated for various sex-race-age categories. Both tables list the actual returns, the differences in returns by sex, and the value of the t statistic for testing the significance of the sex differences. The actual t values are included since it is unclear what should constitute a significant difference in this study, due to the classic problem of deciding between Type I and Type II errors. Since it is really of interest to define returns as either equal or different, any delinea-

TABLE 3

RETURNS TO EDUCATION, MEASURED BY PERCENTAGE CHANGE IN HOURLY WAGE RATE, BY SEX, RACE AND AGE

	Average	Marginal Return by Level (in Years)					
OVERALL	Return	8	9-11	12	13-15	16	17
WOMEN	.0870	.0648	.1211	.1849	.1192	.2969	.0426
MEN	.0471	.0944	.1103	.1079	.0870	.1441	.0126
DIFFERENCE	.0399	(.0296)	.0108	.0770	.0322	.1528	.0300
t statistic[a]	5.767***	.349	.164	2.213**	.841	2.679***	.290
BLACKS							
WOMEN	.0746	(.1489)	.1580	.2191	.0862	.5154	.0461
MEN	.0502	.0731	.0881	.1423	.1513	.1318	(.3100)
DIFFERENCE	.0244	(.2220)	.0699	.0768	(.0651)	.3836	.3561
t statistic[a]	1.986**	1.828*	.702	1.312	.686	2.471**	.689
WHITES							
WOMEN	.0932	.2993	.0587	.1729	.1302	.2657	.0693
MEN	.0462	.0837	.1248	.0782	.0781	.1661	.0252
DIFFERENCE	.0470	.2156	(.0661)	.0947	.0521	.0996	.0441
t statistic[a]	5.569***	1.799*	.755	.917	1.221	1.627	.419
22-25 YEARS							
WOMEN	.0863	.1508	.1233	.1639	.1596	.2439	.0226
MEN	.0341	(.0204)	.1578	.1334	.0334	.0791	.0132
DIFFERENCE	.0522	.1712	(.0345)	.0305	.1262	.1648	.0094
t statistic[a]	5.082***	1.411	.347	.567	2.222**	2.362**	.089
18-21 YEARS							
WOMEN	.0733	(.0448)	.0998	.1918	.0532	.4540	
MEN	.0562	.2202	.0394	.0900	.1079	.1625	
DIFFERENCE	.0171	(.2650)	.0604	.1018	(.0547)	.2915	
t statistic[a]	1.319	2.105**	.647	2.152**	.937	1.696*	

*** significant at .99
** significant at .95
* significant at .90

a) For marginal returns:

$$t = \frac{(a_{w,k} - a_{w,k-1}) - (a_{m,k} - a_{m,k-1})}{\sqrt{\left\{\left\{\sigma_{a^2_{w,k}} + \sigma_{a^2_{w,k-1}} - 2\,\mathrm{Cov}\,(a_{w,k}, a_{w,k-1})\right\} + \left\{\sigma_{a^2_{m,k}} + \sigma_{a^2_{m,k-1}} - 2\,\mathrm{Cov}\,(a_{m,k} a_{m,k-1})\right\}\right\}}}$$

where w indicates a coefficient based on the young women's sample, and m indicates a coefficient based on the young men's sample.

TABLE 4

RETURNS TO EDUCATION MEASURED BY CHANGE IN OCCUPATIONAL SES' CODE, BY SEX, RACE AND AGE

	SES Average Return	Marginal Return by Level (in Years)					
OVERALL		8	9-11	12	13-15	16	17
WOMEN	4.041	5.221	..877	9.374	5.149	18.059	(3.761)
MEN	3.871	(.640)	4.612	6.291	9.851	24.631	4.536
DIFFERENCE	.170	5.861	(3.735)	3.083	(4.702)	(6.572)	(8.297)
t statistic[a]	.504	1.489	1.263	2.336**	3.147***	2.662***	1.761*
BLACKS							
WOMEN	3.392	3.095	..149	7.096	7.006	28.008	(10.452)
MEN	1.868	.530	1.637	3.921	9.806	28.152	9.208
DIFFERENCE	1.524	3.625	(1.488)	3.175	(2.800)	(.144)	(19.660)
t statistic[a]	2.854***	.707	.358	1.315	.764	.023	.912
WHITES							
WOMEN	4.405	7.816	1.303	10.669	4.613	17.171	(2.259)
MEN	4.875	(.547)	7.619	7.079	9.616	24.907	4.624
DIFFERENCE	(.470)	8.363	(6.316)	3.590	(5.003)	(7.736)	(6.883)
t statistic[a]	1.097	1.561	1.461	1.639	2.336**	2.515**	1.330
22-25 YEARS OLD							
WOMEN	4.250	3.876	1.690	9.546	8.150	16.003	(4.364)
MEN	3.241	(3.105)	3.584	7.674	9.912	19.866	4.452
DIFFERENCE	1.009	(6.981)	(1.894)	1.872	(1.762)	(3.863)	(8.816)
t statistic[a]	2.011**	1.237	.407	.721	.637	1.128	1.751*
18-21 YEARS OLD							
WOMEN	3.355	6.903	.668	9.808	1.992	16.772	
MEN	3.134	1.942	4.664	5.222	8.267	27.664	
DIFFERENCE	.221	4.961	(3.996)	4.586	(6.275)	(10.892)	
t statistic[a]	.363	.855	.295	2.098**	2.411	1.378	

*** significant at .99
** significant at .95
* significant at .90

a) For marginal returns:

$$t = \frac{(a_{w,k} - a_{w,k-1}) - (a_{m,k} - a_{m,k-1})}{\sqrt{\left\{\left\{\sigma^2_{a_{w,k}} + \sigma^2_{a_{w,k-1}} - 2\,\mathrm{Cov}\,(a_{w,k}, a_{w,k-1})\right\} + \left\{\sigma^2_{a_{m,k}} + \sigma^2_{a_{m,k-1}} - 2\,\mathrm{Cov}\,(a_{m,k} a_{m,k-1})\right\}\right\}}}$$

where w indicates a coefficient based on the young women's sample, and m indicates a coefficient based on the young men's sample.

TABLE 5

COEFFICIENTS ESTIMATED FOR EQUATION 2, BY SEX, RACE, AND AGE

	Women					Men				
Variable	All	White	Black	18-21	22-25	All	White	Black	18-21	22-25
INTERCEPT	3.5393***	3.4415***	3.8476***	3.8886***	3.3874***	4.584***	4.4432***	3.0679***	4.6868***	4.5667***
EX	.0240***	.0318***	.0090	.0197**	.0193***	.0219***	.0296***	.0006	.0281***	.0140***
TEN	.0006	(.0031)	.0106	(.0388)	.0236	(.0065)	(.0123)*	(.0025)	(.0091)	(.0048)
CHILD	(.0080)	(.0148)	.0073	(.0018)	(.0048)	.0168	.0303**	.0080	.0154	.0190
WW	.0039***	.0038***	.0044***	.0043***	.0039***	.0037***	.0054***	.0014	.0026***	.0060***
RACE	.1000***			.0623	.1343***	.0458			.0940	(.0293)
SMSA	.0395**	.0430**	(.0498)	.0643*	.0501	.0973***	.1010***	(.0199)	.0725*	.1168***
SO	(.0751)***	(.0706)**	(.2505)***	(.0676)	(.0841)**	(.1778)***	(.1880)***	(.3760)***	(.2186)***	(.1516)***
BSO	(.1840)***			(.1397)**	(.2343)***	(.1330)**			(.1539)**	(.0730)
H	.0928***	.1145***	.0442	(.0137)	.2306***	.0412	(.0353)	(.0095)	.1002	(.0210)
MRT	.0177	(.0022)	.0582*	.0097	.0299	.1202***	.1176***	.1077***	.1334***	.0855***
RSO	(.0605)	(.0571)	(.1373)	(.0354)	(.0789)	.0016	.0176	(.0243)	.0145	(.0048)
NC	.0094	(.0082)	(.0363)	(.0466)	.0338	(.1372)	(.0412)	(.0913)	(.0881)	(.2309)
BRSO	.0316			.0415	.0201	.104*			.1315*	.0209
BNC	(.0348)			.0118	(.0436)	.1231			.0098	.2419
DD	(.1272)***	(.1637)***	.0027	(.1564)***	(.0917)*	(.3155)***	(.1502)	(.4604)***	(.3503)***	(.2503)*
DTEN	.0386**	.0453**	.0116	.0053	.0744***	.2613***	.0784	(.4671)***	.2743**	.1140*
FOS	.0004	.0003	.0014	.0001	.0007	.0011**	.0011**	.0027	.0019	.0011
MED	(.0080)*	(.0082)	(.0047)	(.0070)	(.0107)*	.0001	.0003	.0000	(.0001)	.0000
FL14	(.0049)	.0030	(.0068)	(.0077)	.0081	(.0073)	(.0107)	(.0151)	(.0033)	.0147
DFO	(.0136)	(.0062)	(.0340)	(.0007)	(.0373)	.1428	.2027**	(.2908)	.2428	.0888
DME	.0488	.2181**	(.2007)*	(.1330)	.1679*	(.0208)	(.0218)	(.0225)	(.0444)	.0336
RLC14	.0432***	.0559**	.0780**	.0655**	.0661**	.0335	.0606**	(.0219)	.0500	.0224
IQ	.0038***	.0037***	.0041***	.0034***	.0040***	.0019***	.0024***	.0003	.0005	.0028***
DIQ	.0475*	.0516**	(.0360)	.0297	.0605	(.0461)*	(.0574)***	(.0643)	(.0416)	(.0665)*
RDIQ	(.0757)*			(.0679)**	(.0929)	(.0753)*			(.0423)	(.0780)
ED	.0870***	.0932***	.0746***	.0733***	.0863***	.0471***	.0462***	.0502***	.0562***	.0341
R^2	.342	.323	.347	.343	.405	.335	.329	.306	.279	.374

*** significant at .99
** significant at .95
* significant at .90

EX - years spent in the labor force; TEN - years spent on current job; CHILD - number of children; WW - weeks worked in the past year; Race - respondent is non-white; SMSA - respondent lives in an SMSA; SO - respondent resides in the South; BSO - respondent is black and resides in the South; H - respondent's health in year prior to survey restricted work or school activity; MRT - respondent is married; RSO - respondent resides in rural South; NC - respondent resides in a large city outside the South; BRSO - respondent is black and resides in the rural South, BNC - respondent is black and resides in a large city outside the South; DD - information on children is missing; DTEN - information on job tenure is missing; FOS - Socio-economic status of father's occupation as measured by Duncan's SES scale; MED - mother's education; FL14 - parents living together when respondent was 14; DFO - father's occupational data is missing; DME - mother's educational data is missing; RLC14 - respondent resides in a large city at age 14; IQ - IQ score; DIQ - IQ data is missing; RDIQ - respondent is black and IQ data is missing; ED - years of school completed.

tion is purely arbitrary. A "statistically insignificant" difference is also likely to be a "statistically insignficant" equality. Nonetheless, for the discussion which follows, a probability of .90 of a difference existing defines a statistically significant difference, thus minimizing the probability of a Type I error.

In interpreting Tables 3 and 4, it must also be remembered that the returns indicated by the hourly wage rate are inclusive of both current market and current non-market returns, while returns indicated by SES are indicative of current and future market returns. To the extent that women earn their returns outside the market, Table 4 indicates too low a return for women. On the other hand, to the extent that education increases the steepness of the age-earnings profiles of men more than women, Table 3 indicates too low a return for men. Therefore, both tables are necessary to the analysis of relative returns of men and women.

The following general relationships between education, wages and occupation of men and women are indicated by Tables 3 and 4:

1) The average percentage increase in wages due to a year of education is higher for women than for men; the average increase in job status is more similar, although women experience slightly higher average returns.

2) The marginal increase in job status and the marginal percentage increase in wages associated with completion of high school relative to dropping out are higher for women.

3) The marginal percentage increase in wages associated with the completion of college relative to high school is greater for women, but the marginal increase in SES due to college completion is greater for men.

a. Average Years of Attendance

The finding that women experience higher average wage returns to education

is consistent with their higher average years of school attendance. Women's wage returns are greater than men's at .95 level of significance in four out of the five age-race groupings of the data. For the 18 to 21 year old subgroup women's returns are greater than men's, but only at .80 level of significance.

The occupational status return of young women is greater than that of young men at .95 significance in two out of five data breakdowns. For the overall group and for the 18 to 21 year old subgroup, women experienced greater returns than men while white women experienced lesser increases in occupational status than white men, but these differences are not statistically significant. For the reasons discussed above, women are expected to earn higher returns relative to men when wages are the measure of return than when SES is the measure. Although the returns measured by SES are not as significantly higher for women, they are still higher. It, therefore, seems clear that these women are getting a higher average level of return on education. These results are contrary to many previous studies of the return to education. There are four possible explanations of this contrasting result:

First, previous studies making such comparisons have been based on annual income data while the present study is based on the hourly wage rate.[16] The latter approach is expected to indicate a more favorable returns position for women, since both market and non-market productivity are measured implicitly.

Second, previous studies have measured the return over the entire working life while this study focuses on the narrower 18 to 25 year old age span. Women could receive higher returns early in life but lower returns later so that the return over the entire life span is lower for women. If 18 to 25 year old men receive relatively more training, they would experience greater

wage increases in the future and lower monetary wages in the present since their remuneration included training as well as wages. Since estimations of return based on change in SES also indicate that education yields greater returns for women, training is not likely to explain the whole difference. Furthermore, two additional estimations were performed to detect whether any training-bias existed in the estimation of average returns. First, the total number of hours spent in formal job training was included as a variable in the Z vector and equation (2) was re-estimated. The coefficient of education did not change for either sex.[17] Secondly, equation (2) was re-estimated with the percentage change in hourly wage rate between 1968 and 1969 as the dependent variable. Although the young men experienced greater growth in earnings than did the young women (16.5% vs 11.8%), the increase associated with education was significantly (at .99 level) greater for the women.[18] The young men in this sample were apparently not receiving more on-the-job training as a result of prior educational attainment than were the young women. Therefore, there is no evidence that lifetime earnings figures for these workers would yield contrary results.[19]

Third, if the military draft selects the "higher return" workers out of the subsample and also prompts those in the subsample to stay in school solely to avoid military service, the estimate of sex differences in the return to education is biased.

To assess these effects, the young women's average and marginal returns to education are compared with those of the young men grouped by draft classification. These results are reported in Table 6. The young women experience greater wage returns relative to all draft groups. These differences are significant at the .95 level for all but one category (IV F's). It is par-

TABLE 6

RETURNS TO EDUCATION BY SEX AND SELECTIVE SERVICE CLASSIFICATION

WAGES	Average Return	Marginal Return by Level					
		8	9-11	12	13-15	16	17
YOUNG WOMEN	.0870	.0648	-.1211	.1849	.1192	.2969	.3426
IA MEN	.0462	.0103	.0393	.0469	.1244	.0361	.6137
DIFFERENCE	.0408	.0545	.0618	.1180	(.0052)	.2608	(.3711)
t statistic[a]	2.177**	.337	.439	.715	.048	1.780*	1.629
III-A MEN	.0456	.2069	.0821	.1067	.0044	.1944	.1914
DIFFERENCE	.0414	(.1441)	.0390	.0782	.1148	.1025	(.1488)
t statistic[a]	3.381***	.996	.384	1.425	1.736*	1.020	.615
IV MEN	.0276	.0140	.0574	.0647	.0230	.1410	.1010
DIFFERENCE	.0594	.0508	.0637	.1482	.0942	.1539	(.0384)
t statistic[a]	5.736***	.438	.640	2.582***	1.595	1.739*	.139
IV-F MEN	.0688	(.0266)	.2812	.1175	.0256	.4052	(.1799)
DIFFERENCE	.0182	.0914	(.1601)	.0474	.0936	(.1083)	.2225
t statistic[a]	1.078	.687	1.284	.753	.702	.438	.695
OTHER	.0643	.3690	.1451	.0753	.2046	.1266	(.1102)
DIFFERENCE	.0227	(.3042)	(.0240)	.1096	(.0834)	.1703	.1528
t statistic[a]	2.309**	2.231**	-.195	1.821*	1.544	2.152**	1.156
SEX							
YOUNG WOMEN	4.061	5.221	.877	9.374	5.149	18.039	(3.761)
IA MEN	4.460	(5.231)	5.873	4.062	11.880	20.738	25.421
DIFFERENCE	(.419)	10.452	(4.996)	5.312	(6.731)	(2.679)	(29.182)
t statistic[a]	.434	1.264	.791	2.279**	1.940*	.455	1.678*
III A MEN	5.201	11.350	2.112	7.281	12.351	21.709	3.155
DIFFERENCE	(1.160)	(6.129)	(1.235)	2.093	(7.202)	(3.650)	(6.916)
t statistic[a]	1.671*	.757	.218	.678	1.912*	.639	.499
IV MEN	3.619	(2.002)	1.811	6.279	8.824	18.340	13.817
DIFFERENCE	0.422	7.223	-.934	3.093	(3.675)	.481	(17.378)
t statistic[a]	.503	1.286	.192	1.158	1.230	.110	2.627***
IV F MEN	1.646	(3.262)	4.927	.479	1.412	32.791	(9.251)
DIFFERENCE	2.375	8.483	(4.050)	8.895	3.737	(14.732)	5.490
t statistic[a]	3.539	1.705*	.895	2.802***	.799	1.705*	.486
OTHER	4.346	(.392)	8.650	6.171	10.168	29.831	.998
DIFFERENCE	.305	5.613	(7.773)	3.203	(5.019)	(11.772)	(4.759)
t statistic[a]	.3807	.708	1.225	1.033	1.769*	2.921***	.721

*** significant at .99
** significant at .95
* significant at .90

a) For marginal returns: $$t = \frac{(s_{w,k} - s_{w,k-1}) - (s_{m,k} - s_{m,k-1})}{\sqrt{\left\{\sigma^2_{w,k} + \sigma^2_{w,k-1} - 2\,\mathrm{Cov}\,(s_{w,k}, s_{w,k-1})\right\} + \left\{\sigma^2_{m,k} + \sigma^2_{m,k-1} - 2\,\mathrm{Cov}\,(s_{m,k} s_{m,k-1})\right\}}}$$

ticularly interesting that this result holds for III A's since a condition of eligibility for this classification is that the individual never had a student deferment.[20] The III A group, therefore, never stayed in school to avoid the draft.

The average return as measured by occupational status does show some sensitivity to draft classification. The III A's experience significantly (at .90) greater SES returns than the women; the IV F's experience significantly (at .99) lower SES returns, and the returns to men in the other classifications are not significantly different from those of women.

Nonetheless, it seems unlikely that the young men would have experienced an increase in SES from education greater than that of young women had there not been a military draft in 1969. Although the group who made their educational choices unaffected by the draft shows the greatest increase, their mean years of education is equal to the mean for the entire subsample. It is more likely that their greater increase is due to their experience and to the work motivation that a wife and children are likely to induce. No other draft classification would have changed the conclusion drawn from Table 4.

Therefore, the draft does not seem to have affected the young men's sample in such a way as to change the conclusion that women earn greater average returns from education than men do.

Finally, this study may have different results than earlier work because there have been changes over time so that more recent data indicates a structural change in the economic opportunities which education offers women.

In any case, the higher average rate of return to women in this sample provides an economic rationale for their higher average years of school attendance.

b. Marginal effects of high school graduation

However, it is the difference in the pattern of educational attainment of men and of women which is of particular interest for this study. The sex differences in the marginal effects of a high school diploma on both wages and occupational rank are consistent with women being more likely than men to complete high school. Women experience both higher wage and occupational status returns than men from the completion of the twelfth year of schooling. This result holds for all subsets of the data reported in Tables 3, 4, and 5. The marginal return in both wages and occupation is significantly (at .95 level) higher for women in the overall comparison and in the 18-to-21 year olds comparison. The marginal return in wages is significantly higher for women than for IY men (at .99 level) and for "other" classifications (at .90 level) and the marginal change in SES is significantly (at .95 level) higher for women than for IA and IV F men.

It is also worth noting that Tables 3, 4 and 5 indicate that men, who are more likely to drop out of high school, fare better than women when they do drop out. For all subgroup comparisons with 9 to 11 years of schooling, men experience greater increases in SES, although these differences are not statistically significant. Wage returns, however, are mixed. In only two of five age-race groupings and in only two of five draft groupings, do the men experience greater wage returns than the women, although none of the differences are statistically significant.

Nonetheless, the results reported in Tables 3, 4 and 5 clearly show that women's relative (to men's) returns are higher for high school completion than they are for dropping out of high school. Therefore, this study supports the hypothesis that sex differences in economic returns to high school graduation

are consistent with women being more likely than men to receive a high school diploma and less likely to drop out short of that diploma.

c. Marginal effects of higher education

Sex differentials in the return to a college diploma are less obvious; but sex differentials in educational attainment are also less striking (see Table 1).

Tables 3, 4 and 5 indicate that women's occupational gains from a college diploma are less than men's across every data subsample. This difference is statistically significant in the overall sample (at .99) in the white subsample (at .95), and in comparing women with IV F men (at .90) and with the "other" draft classifications (at .99). It is interesting to note that the lower occupational gains of women pervade all post-high school education. Women experienced lower occupational gains in all 14 of the age-race-education categories for post-high school years listed in Table 4; this difference is statistically significant at a minimum level of .90 in 7 of these cases. Table 5 collaborates these results. In 13 of 15 comparisons of post-high school occupational returns, women fared worse than men. The only men who experienced lesser occupational gains from post-high school education than women were IV F men who stopped short of the college diploma or who went onto post-graduate work. The wage returns do not tell so clear a story, however. Women experienced a larger percentage increase in hourly wages from a college diploma in all subgroups compared in Table 3. The difference is statistically significant at .99 level for the total subsample and at .90 level for 18 to 21 year olds. A comparison of women's returns with men grouped by draft classification further supports this result. Women experienced significantly (at .90 level) higher wage returns than IA, IY, and "other" classified men, insignificantly higher returns than III A men and insignificantly lower returns than IV F men. For

post-high school education as a whole, women received higher wage returns than men in 12 of 14 age-race-education categories listed in Table 3. In only two of these categories is the difference statistically significant, however. Table 5 indicates that women earn higher wage returns than men in only 9 of 15 draft-education categories, three of which are significant at .90 level.

If occupational ranking measures the economic return to education more accurately than current wage rates for this cohort of the population, then sex differences in patterns of educational attainment are explainable by economic rationale. Furthermore, the results from Tables 3 and 4 are reconcilable if one interprets these results as indicative of the shape of age-earnings profiles by education and sex. Table 3 specifies the differences in earnings at younger ages for individuals achieving different levels of education within sex groups. Young college graduate women earn more relative to young high school graduate women than do young college graduate men relative to young high school graduate men. Table 4 is indicative of differences in earnings at older ages. College graduate men experience greater rates of increase in future earnings relative to high school graduate men than do college graduate women relative to high school graduate women. College produces steeper age-earnings profiles for men than it does for women.

On the basis of such interpretation, this study supports the hypothesis that sex differences in lifetime economic returns to college graduation are consistent with men being more likely than women to receive a college degree, but finds no support for sex differences in college attendance on the basis of sex differences in currect wage returns.

VI. Conclusion

This study generally supports the hypothesis that sex differences in labor market experiences explain sex differences in educational attainment. Since women and men do not experience the same gains in wages and occupational status from the same level of education, it is not surprising that educational attainment differs by sex. The most striking sex difference in education patterns is the greater proportion of women than men who receive exactly a high school education. The most striking sex difference in returns to education found here is the relatively greater return to women from high school graduation.

However, this study does not attempt to explain the basis for sex differences in the return to education. It seems plausible that women are disadvantaged in competing with men for the manual jobs which employ high school dropout men and for the jobs with substantial amounts of training which employ college-educated men. On the other hand, men may be relatively disadvantaged in competing with women for the clerical jobs which employ high school graduate women. Whether these relative "disadvantages" are due to employer discrimination or to productivity differences is frequently discussed in the literature, and is not the subject of this paper. Nonetheless, this study demonstrates that, whether sex wage differentials stem from productivity differentials or from discrimination, they do explain sex differences in educational attainment, suggesting that educational differences between men and women are the result, and not the cause, of differences in job opportunities.

APPENDIX A

Measuring the Return to Education in Housework: An Analysis of the Effect of Housewives' Education on Other Family Members.

While the main body of this report values housework by using the hourly wage rate to indicate the opportunity cost of time spent in housework, other techniques for determining the implicit value of housework are discussed here. Specifically, an efficiently-run household is likely to positively affect the labor market productivity of other household members. Lee Benham [6] argues that since people learn from their associates and since learning increases productivity and earnings, an educated wife transfers information to her husband which, in turn, increases his productivity and earnings. Benham's empirical study finds that wives' education positively affects husband's earnings and that this effect is one half the effect of husband's own education. While this indicates that there are definite returns to a housewife's education, it focuses on only one aspect of household activity. It is also reasonable to place a more general interpretation on Benham's result. If productivity on the job is enhanced by a well-run home and personal life and if education enables one to engage more efficiently in general household production, then an efficiently-run household should increase the productivity of all members of that household. The positive effect of wives' education on husbands' earnings would result from general household efficiency as well as the higher quality companionship postulated by Benham.

From the NLS sample of young men and women, 131 married couples were identified for whom both husband and wife were respondents and for whom there was complete data on the relevant variables. Six couples were excluded due to missing values for one or more variables. The natural logarithm of husband's wages (LNW) was regressed on wife's education (WED), and on his

education (ED) , occupational socio-economic status (SES) , experience (EX) , and on the number of years of marriage (YR) , to yield the following result:

$$\begin{aligned} LNW = {} & 4.615 + .037\,WED + .042\,ED \\ & (.297) \quad (.017) \quad (.020) \\ & + .001\,SES + .036\,EX + .021\,YR \\ & (.001) \quad (.016) \quad (.039) \end{aligned}$$

$$R^2 = .167$$

$$F: \quad 5.03$$

Wife's education was not only significant at the .05 level in correlating with husband's wages, it also was 88% as effective as his own education. However, the direction of causation in this correlation is not clear. As discussed above, Gary Becker explains this correlation by arguing that schools are a good place for women to meet "higher wage men", so that women with more education marry higher earners. Wives' education is so highly correlated with husbands' education that it is statistically impossible to distinguish the two hypotheses.

Furthermore, even if these income effects were the result of wives' educations, they would extend to all other members of the household and are potentially larger than just the effect on husband's income. To explore this possibility, the effect of mother's education on factors which determine the income of both young men and young women was analyzed. Table A-1 lists the results of regressing several personal and socioeconomic variables on level of educational attainment and on measured I.Q. These equations indicate that mother's educational attainment has little effect on the I.Q. or educational attainment of sons but strong, positive effects for daughters. Education either increases the time a mother devotes to her daughters relative to her sons or increases the "efficiency" of her care for daughters

TABLE A-1

THE DETERMINANTS OF EDUCATIONAL ATTAINMENT AND I.Q. BY SEX[a]

Independent Variables[b]	Education		I.Q.	
	Women	Men	Women	Men
Intercept	-2.379	-1.171	90.680	97.360
	(.299)	(.302)	(1.876)	(1.360)
FOS	.00004	.00008	.0015	.0016
	(.00001)	(.00002)	(.0002)	(.0002)
MED	.143	-.012	.930	-.013
	(.013)	(.003)	(.143)	(.035)
SIB	-.026	-.050	-.376	-.500
	(.006)	(.007)	(.061)	(.071)
RACE	.586	.314	-13.460	-11.059
	(.092)	(.123)	(.967)	(1.286)
DME	.377	.374	.630	2.688
	(.057)	(.073)	(.528)	(.639)
PL14	.195	.179	.679	.414
	(.057)	(.070)	(.614)	(.735)
DFO	-.356	-.444	-4.867	-5.500
	(.242)	(.204)	(2.624)	(2.154)
RLC14	-.022	.038	.351	-.757
	(.000)	(.061)	(.655)	(.647)
SMSA	.026	-.181	-1.020	-2.701
	(.063)	(.093)	(.686)	(.984)
MC	.100	.115	-.744	3.283
	(.074)	(.080)	(.803)	(.846)
RSO	-.017	-.160	-3.147	-3.940
	(.106)	(.086)	(1.157)	(.916)
BRSO	-.046	.459	-.002	-3.678
	(.138)	(.175)	(1.491)	(1.843)
BNC	-.367	-.081	1.464	-2.007
	(.132)	(.153)	(1.428)	(1.617)
SO	-.055		-.575	
	(.074)		(.801)	
IQ	.029	.033		
	(.002)	(.002)		
AGE	.470	.478		
	(.009)	(.009)		
R^2	.545	.548	.264	.243
SEE	1.201	1.307	13.034	13.919

[a]Numbers in parentheses indicate the standard error of the coefficient.

[b]See Table 5 for interpretation of independent variables.

relative to sons. That is, mothers may be perceived as a role model by daughters but not by sons so that mother's education positively affects daughter's achievement, but is independent of son's.

The role model effect can explain the difference in the coefficients in the education equations but not in the I.Q. equations if I.Q. is a measure of innate ability. The coefficients in the I.Q. equations are more perplexing since neither the differences in perceptions of role model nor genetics explain why mother's education affects daughter's I.Q. more than son's. If I.Q. is measuring achievement rather than innate ability, however, then the role model explanation would work.

Actually, both effects are probably occurring. Arlene Liebowitz [10] has found that the time mothers spend on child care is an increasing function of education. While sex of children is not considered, it would be surprising if this added time was only spent on daughters, but daughters may well receive a higher proportion of the additional time. These results indicate that there are household returns to mother's education.

APPENDIX B

What the Return Measures: Education, Race and Sex as Screening Devices

While it is clear that education is positively correlated with earnings and occupational status, the causative connection is the subject of ongoing dabate. There are three principal hypotheses which dominate the ongoing debate: the human capital model, the signaling model, and the "licensing" model. The human capital model postulates that education increases earnings by directly increasing productivity. The signaling model reverses the causation by postulating that education does not itself increase productivity, but rather "signals" an array of less easily observed worker characteristics which are the determinants of productivity. In other words, education is acquired by workers to indicate a productivity level which has preceded the acquisition of education. The "licensing" model asserts that earnings increase with education because education is a requirement for entry to certain high paying occupations and, therefore, acts to shift the supply curve for workers in those occupations backwards, increasing the wage rate.

All of these explanations may be accurate to some extent, but their relative significance may differ by race-sex groupings. While it is not the purpose of this paper to provide a definitive answer on the question of the causal relationship between education and income, some assessment as to how these influences are of greater or lesser importance for different race-sex groupings is of crucial importance to understanding the relationship between education and employment, wage, and prestige differentials by race and sex. To the extent that race and sex are themselves screening or licensing devices, they may interact with education to yield different employment effects.

The results of a screening test, first used by Taubman and Wales [16] to analyze the effect of education for a male sample, are presented in Tables

B-1 through B-4. This test is designed to analyze the effect of different levels of education on the occupational choices and opportunities of each race-sex grouping. To compile these tables, the actual distribution of respondents by occupation and education was determined and is listed in columns 1 and 3. Earnings equations by occupation were estimated in the explicit form of equation (2). (See Table B-5) Each respondent's personal, background, and ability characteristics were then plugged into these equations to determine the expected wage rate for the respondent in each occupation. The expected occupational distribution (columns (2) and (4) of Tables B-1 through B-4) was computed on the assumption that the respondent was expected to be employed in the occupation which yields the highest expected wage rate. Column (5) measures the difference between the expected and actual occupation distribution.

Table B-6 lists the race-sex-education groupings in order of efficiency of occupational selection as measured by an efficiency index, which is each group's sum of the squared differences listed in column (5) of Tables B-1 through B-4. The closer this number is to zero, the closer the group members are to a wage-efficient occupational distribution. From this information, the personal characteristic most likely to screen one out of a wage-optimal occupation is being a woman while the characteristic most likely to get one into a wage-optimal occupation is being a man. Race also affects the likelihood of being in the most efficient occupation, but not as dramatically as sex. A college education increases the likelihood of choosing the wage maximizing employment. This could be due to college increasing the worker's capacity to determine his or her highest paying alternative or it may indicate a credential or sheepskin effect. High school graduates are less likely than high school dropouts to be in the "right" occupation, though it is the experience of blacks and white women which have prompted this result. White male high school graduates are

more efficiently distributed over occupations than white male dropouts.

In terms of specific occupations, women are more likely to be screened from the professions, regardless of education or race, than are males and they are similarly more likely to be overrepresented in clerical and service occupations. (This overrepresentation is an increasing function of education for black women.) For both men and women, and blacks and whites, lower levels of education increased the overrepresentation in operative jobs, while black men had a similar experience with laborer jobs.

TABLE B-1

TEST OF OCCUPATIONAL SCREENING BY EDUCATION:

YOUNG WHITE WOMEN 18-25 IN 1969

Occupation	(1) Actual Number	(2) Expected Number	(3) Actual Fraction	(4) Expected Fraction	(5) Difference
		More than a High School Education			
Professional	163	318	.50	.97	.47
Manager	3	0	.01	.00	(.01)
Clerical	127	4	.39	.01	(.38)
Sales	12	1	.04	.01	(.03)
Crafts	0	2	.00	.01	.01
Operatives	9	0	.03	.00	(.03)
Laborers	0	0	.00	.00	.00
Service	14	3	.04	.01	(.03)
Domestics	0	0	.00	.00	.00
		Exactly a High School Education			
Professional	27	574	.03	.65	.62
Manager	10	1	.01	.00	(.01)
Clerical	518	68	.58	.08	(.50)
Sales	61	3	.07	.00	(.07)
Crafts	8	210	.01	.24	.23
Operatives	114	16	.13	.02	(.11)
Laborers	9	2	.01	.00	(.01)
Service	120	14	.13	.01	(.12)
Domestics	22	1	.02	.00	(.02)
		Less Than a High School Education			
Professional	2	113	.01	.46	.45
Manager	4	1	.02	.00	(.02)
Clerical	52	11	.21	.04	(.17)
Sales	19	0	.08	.00	(.07)
Crafts	4	96	.02	.39	.37
Operatives	94	20	.38	.08	(.30)
Laborers	2	0	.01	.00	(.01)
Service	56	6	.23	.02	(.21)
Domestics	14	0	.06	.00	(.06)

TABLE B-2

TEST OF OCCUPATIONAL SCREENING BY EDUCATION:

YOUNG WHITE MEN 18-25 IN 1969

Occupation	(1) Actual Number	(2) Expected Number	(3) Actual Fraction	(4) Expected Fraction	(5) Difference
		More than a High School Education			
Professional	109	201	.36	.67	.31
Manager	37	11	.12	.04	(.08)
Clerical	29	8	.10	.03	(.07)
Sales	30	16	.10	.05	(.05)
Crafts	26	55	.09	.18	.09
Operatives	35	4	.12	.01	(.11)
Laborers	23	3	.08	.01	(.07)
Service	13	4	.04	.01	(.03)
		Exactly a High School Education			
Professional	20	87	.04	.17	.13
Manager	36	13	.07	.02	(.05)
Clerical	55	10	.10	.02	(.08)
Sales	25	17	.05	.03	(.02)
Crafts	120	293	.23	.56	.33
Operatives	198	90	.38	.17	(.21)
Laborers	53	14	.10	.03	(.07)
Service	19	2	.04	.00	(.04)
		Less than a High School Education			
Professional	4	49	.01	.16	.15
Manager	10	7	.03	.02	(.01)
Clerical	14	6	.05	.02	(.03)
Sales	8	20	.03	.06	.03
Crafts	70	164	.23	.53	.30
Operatives	129	43	.42	.14	(.28)
Laborers	61	19	.20	.06	(.14)
Service	12	0	.04	.00	(.04)

TABLE B-3

TEST OF OCCUPATIONAL SCREENING BY EDUCATION:

YOUNG BLACK WOMEN 18-25 IN 1969

Occupation	(1) Actual Number	(2) Expected Number	(3) Actual Fraction	(4) Expected Fraction	(5) Difference
		More than a High School Education			
Professional	23	66	.32	.93	.61
Manager	0	0	.00	.00	.00
Clerical	29	1	.41	.01	(.40)
Sales	3	1	.04	.01	(.03)
Crafts	1	2	.01	.03	.02
Operatives	10	1	.14	.01	(.13)
Laborers	0	0	.00	.00	.00
Service	4	0	.06	.00	(.06)
Domestics	1	0	.01	.00	(.01)
		Exactly a High School Education			
Professional	8	180	.03	.59	.56
Manager	0	0	.00	.00	.00
Clerical	124	21	.41	.07	(.34)
Sales	10	18	.03	.06	.03
Crafts	1	64	.00	.21	.21
Operatives	87	14	.29	.05	(.24)
Laborers	0	0	.00	.00	.00
Service	60	4	.20	.01	(.19)
Domestics	13	2	.04	.01	(.03)
		Less Than a High School Education			
Professional	5	100	.02	.50	.48
Manager	0	0	.00	.00	.00
Clerical	30	4	.15	.02	(.13)
Sales	3	24	.01	.12	.11
Crafts	2	54	.01	.27	.26
Operatives	57	13	.28	.06	(.22)
Laborers	1	0	.00	.00	.00
Service	77	6	.38	.03	(.35)
Domestics	26	0	.13	.00	(.13)

TABLE B-4

TEST OF OCCUPATIONAL SCREENING BY EDUCATION:

YOUNG BLACK MEN 18-25 IN 1969

Occupation	(1) Actual Number	(2) Expected Number	(3) Actual Fraction	(4) Expected Fraction	(5) Difference
		More than a High School Education			
Professional	20	23	.43	.50	.07
Manager	1	0	.02	.00	(.02)
Clerical	8	0	.17	.00	(.17)
Sales	0	17	.00	.37	.37
Crafts	1	3	.02	.07	.05
Operatives	11	1	.24	.02	(.22)
Laborers	4	1	.09	.02	(.07)
Service	1	1	.02	.02	.00
		Exactly a High School Education			
Professional	3	14	.02	.07	.05
Manager	3	1	.02	.01	(.01)
Clerical	32	5	.16	.03	(.13)
Sales	1	130	.01	.65	.64
Crafts	23	29	.12	.15	.03
Operatives	81	11	.41	.06	(.35)
Laborers	38	5	.19	.03	(.16)
Service	18	4	.09	.02	(.07)
		Less Than a High School Education			
Professional	2	36	.01	.14	.13
Manager	2	1	.01	.00	(.01)
Clerical	15	0	.06	.00	(.06)
Sales	0	121	.00	.47	.47
Crafts	31	65	.12	.25	.13
Operatives	109	25	.42	.10	(.32)
Laborers	77	8	.30	.03	(.27)
Service	24	4	.09	.02	(.07)

TABLE B-5

EARNINGS EQUATIONS BY OCCUPATION, YOUNG MEN AND YOUNG WOMEN, 1969

	Occupation							
Variable	Prof.	Clerical	Sales	Operative	Craft	Service	Manag.	Labor
Intercept	4.947	5.120	4.625	5.414	5.249	4.431	5.071	5.536
	(.158)		(.246)	(.041)		(.204)		
Drop	-.268	-.192	-.124	-.107	-.136	-.189	-.085	-.082
	(.102)		(.061)	(.020)		(.045)		
Col	.251	.078	.047		.118	.301	.115	
	(.051)		(.058)			(.082)		
Age			.049			.034		
			(.011)			(.010)		
Race			.200			.146	-.185	
			(.077)			(.065)		
SMSA		.099		.047	.120		.189	
				(.020)				
SO		-.095		-.155	-.239		-.141	-.337
				(.025)				
BSO		-.067		-.064		-.354		
				(.029)		(.073)		
MRT	.064			.125 (M)	.191 (M)	.082		.139 (M)
	(.031)			(.026)		(.045)		
H				.100	.146			
				(.037)				
IQ	.003	.002					.005	
	(.001)							
PT		-.069		-.098			-.266	-.238
				(.037)				
FOS				.002				
				(.001)				
MED	.005							
	(.003)							
DME	.115							
	(.038)							
DFO				-.083				
				(.044)				
EX	.044	.027			.020		.028	
	(.011)							
RLC14		.043	.109					
			(.056)					

TABLE B-5 (cont.)

Variable	Prof.	Clerical	Sales	Operative	Craft	Service	Manag.	Labor
RSO	-.192		-.284			-.206		
	(.041)		(.072)			(.081)		
BRSO						.301		
						(.111)		
NC					-.090			
DIQ								
BDIQ								
WW	.005	.004		.003	.004	.005		.003
	(.001)			(.001)		(.001)		
Sex	-.143	-.287	-.562	-.315	-.246	-.288	-.443	-.296
	(.036)		(.051)	(.039)		(.055)		
SIB								-.007
R^2	.332		.582	.441		.297		

TABLE B-6

INDEXES OF INCOME OPTIMALITY OF OCCUPATIONAL DISTRIBUTION BY SEX, RACE AND EDUCATION

Index	Group
.1384	White men with more than high school education
.1857	White men with exactly high school education
.2140	White men with less than high school education
.2269	Black men with more than high school education
.3682	White women with more than high school education
.4386	Black men with less than high school education
.5114	White women with less than high school education
.5148	Black women with less than high school education
.5540	Black women with more than high school education
.5688	Black women with exactly high school education
.5830	Black men with exactly high school education
.7193	White women with exactly high school education
.1794	White men
.5330	White women
.4162	Black men
.5459	Black women
.1827	College men
.4611	College women
.3844	High school men
.6441	High school women
.3263	Dropout men
.5131	Dropout women
.3905	College blacks
.2533	College whites
.5759	High school blacks
.4525	High school whites
.4767	Dropout blacks
.3627	Dropout whites
.3562	Whites
.4810	Blacks
.2978	Men
.5394	Women
.3219	College
.5142	High school
.4197	Dropout

FOOTNOTES

[1]See U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, 1972, N. 168.

[2]A summary of these differences can be found in Edwin C. Lewis, [11, pp. 188-189].

[3]Becker [2], p.].

[4]T.W. Schultz, "The Reckoning of Education as Human Capital," in W. Lee Hansen (ed.) Education, Income, and Human Capital (New York: National Bureau of Economic Research, 1970), pp. 302-3.

[5]Since the purpose of most of the human capital work has been to determine the effect of education on income, the male emphasis is justified for two reasons. First, wage and employment discrimination affects both the productivity and the income of women workers. Extra-market criteria have a relatively larger effect on the employment of women, and therefore, a larger effect on their return to education. Second, the expected labor force participation rate for women is lower, supposedly indicating that the educational choices of women are more strongly focused on the consumption value of education. Therefore, the non-pecuniary returns to education are a larger part of the total return for women. Because it is more difficult to measure non-market returns, it would seem appropriate to investigate the relationship between education and income in terms of male education-earnings patterns where non-market returns are not as significant.

[6]That women are actually able to allocate their work hours so as to set their marginal valuation of non-work hours equal to their wage rate

may be questioned. While for any particular job a worker may not be able to determine the number of hours worked, the evidence suggests that a worker could select from an array of jobs over which hours per week varied tremendously. During the week the young women were surveyed, for example, 26.3% (of those working) worked less than 15 hours, 14.5% worked 15 to 25 hours, 11.6% worked 25 to 35 hours, 42.1% worked 35 to 45 hours, 3.0% worked 45 to 55 hours, and 2.1% worked over 55 hours. Furthermore workers were likely to be in a relatively strong bargaining position since the labor market in 1969 was extremely tight, with an average unemployment rate for the total labor force of 3.5%.

[7]Only the marginal value of time in market and non-market uses is actually quantified. The transformation to total value is more difficult. The total value of individual returns from employment is simply the wage rate times the number of hours worked. Assuming diminishing marginal productivity, the total return to non-market time is greater than the wage rate times the number of hours worked. Since household output is not marketed, there is no way to directly evaluate the total product or the marginal product spent in non-market activity. The value of this output of the family could only be measured in terms of their marginal utility for the product. To be consistent, this would require that labor market returns also be evaluated in terms of the family's marginal utility of income. No research has attempted such measurement. Traditionally, income is chosen as the measure of evaluation of private return from employment. Likewise, housework is also evaluated at the margin. This results in an underestimate of the total value of housework and probably biases my estimate of the return to education.

[8]For further discussion of this point, see Reuben Gronau [7,8].

[9]Although educational attainment is positively correlated with hours

worked per year, no adjustment is made for this in the estimate of the return. As explained above, the wage rate indicates the marginal value of time in all other uses, so those who work less hours for wages have determined that the value of their time in alternative uses at the margin is equivalent to its value on the job. To compute the increase in income which results from additional hours worked as a part of the return biases the results to show higher returns for those who produce in the market relative to those who engage in non-market production.

[10]2292 respondents were either enrolled in school or did not answer: 77 were under 18; 719 were deleted due to failure to report income; and 15 were deleted due to lack of occupational or educational data.

[11]1392 respondents were still enrolled in school; 620 were under 18 or over 25; 1501 were deleted due to a failure to report income -- this includes 689 in the armed forces and 179 who could not be located in 1969; and 185 were deleted due to a lack of educational or occupational data.

It is important to note that all males serving in the armed forces in 1966, approximately 18 percent of young men 15 to 24 years of age in 1966, were ineligible for the initial sample. Since the men in this sample were 15 to 22 years old in 1966, the percentage should be lower for them. It is uncertain to what extent this biases the male sample since there is no information on the group excluded in 1966. However, the 689 of this group who joined the armed forces since 1966 are of the same mean level of educational and IQ attainment as the civilian sample but blacks are underrepresented in military service.

[12]Women aged 30-44 in 1967 and men aged 45-54 in 1966 were also surveyed.

[13]Furthermore, this breakdown permits analysis of a data subset not af-

fected by the initial survey bias (see fn. 11), since these young men were 15 to 18 years old in 1966 and therefore too young to have been in the military.

[14]For a complete discussion of this index and the methodology of its construction, see O.D. Duncan [4].

[15]The specific variables included in Z, as well as their coefficients estimated with equation (2) for various sex-race-age categories are included in Table 6.

[16]However, Mincer and Polachek [13, p. S102] reached similar conclusions by measuring the returns to education for men and women aged 30 to 44 in 1966 using the hourly wage rate. They found that married women experienced a lower rate of return than married men (.063 vs .071) while a single women experienced a higher rate of return (.077). While they did not report any tests for statistical significance of these differences nor did they analyse marginal returns by year of education, their estimate of the average return using hourly wage rates is consistent with those reported here.

[17]While the young women were more likely to have had formal on-the-job training than were the young men, the women who received training received less extensive training (as measured by number of hours trained) than did the young men. When equation (2) was re-estimated including total hours trained the coefficient of education was not significantly (at .90) different from that estimated by (2) without a training variable.

[18]Regression estimates indicate that, for the men, the effect of a year of education on the rate of growth in hourly wages between 1968 and 1969 was - .0017 (t = - .35) and for the women, the effect was .0173 (t = 3.18).

[19]However, as discussed later in this paper, there is evidence that college-educated men experience greater increases in SES than college-

educated women.

[20]See Section 6 (h) of the Military Selective Service Act.

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